



STIC Search Report

EIC 1700

STIC Database Tracking Number: 204573

TO: Tony S Chuo
Location: REM 6C11
Art Unit : 1745
October 23, 2006

Case Serial Number: 10/668976

From: Ross Shipe
Location: EIC 1700
REMSSEN 4B31
Phone: 571/272-6018
Ross.Shipe@uspto.gov

Search Notes

Examiner Chuo:

Please review the attached search results.

The first reference set has both cathode and anode being nanotubes and starts on page 2.

The second answer set has an anode or cathode with mwnt or swnt and starts on page 20.

I did a broader search of nanotube# (2a) anode and nanotube# (2a) cathode with lithium battery.

I got 4 hits that start on page 35.

If you have any questions or if you would like to refine the search query, please feel free to contact me at any time.

Thanks you for using EIC 1700 search services!

Ross Shipe (ASRC)
Technical Information Specialist



Access DB# 214573

SEARCH REQUEST FORM

Scientific and Technical Information Center

Requester's Full Name: C50 Examiner #: _____ Date: 10/23/06
Art Unit: _____ Phone Number 30 _____ Serial Number: 14668526
Mail Box and Bldg/Room Location: _____ Results Format Preferred (circle): PAPER DISK E-MAIL

If more than one search is submitted, please prioritize searches in order of need.

Please provide a detailed statement of the search topic, and describe as specifically as possible the subject matter to be searched. Include the elected species or structures, keywords, synonyms, acronyms, and registry numbers, and combine with the concept or utility of the invention. Define any terms that may have a special meaning. Give examples or relevant citations, authors, etc, if known. Please attach a copy of the cover sheet, pertinent claims, and abstract.

Title of Invention: Cathode Lithium battery
Inventors (please provide full names): _____

Earliest Priority Filing Date: _____

**For Sequence Searches Only* Please include all pertinent information (parent, child, divisional, or issued patent numbers) along with the appropriate serial number.*

STAFF USE ONLY

	Type of Search	Vendors and cost where applicable
Searcher: <u>RS</u>	NA Sequence (#) _____	STN <u>✓</u>
Searcher Phone #: _____	AA Sequence (#) _____	Dialog _____
Searcher Location: _____	Structure (#) _____	Questel/Orbit _____
Date Searcher Picked Up: _____	Bibliographic <u>✓</u>	Dr.Link _____
Date Completed: <u>10/23/06</u>	Litigation _____	Lexis/Nexis _____
Searcher Prep & Review Time: <u>30</u>	Fulltext _____	Sequence Systems _____
Clerical Prep Time: _____	Patent Family _____	WWW/Internet _____
Online Time: <u>34</u>	Other _____	Other (specify) _____

Banks, Kendra

204573

From: TONY CHUO [Tony.Chuo@uspto.gov]
Sent: Monday, October 16, 2006 1:42 PM
To: STIC-EIC1700
Subject: Database Search Request, Serial Number: 10668976

Requester:
TONY CHUO (P/1745)
Art Unit:
GROUP ART UNIT 1745
Employee Number:
81950
Office Location:
REM 06C11
Phone Number:
(571) 272-0717
Mailbox Number:

Case serial number:
10668976
Class / Subclass(es):
429/122
Earliest Priority Filing Date:
5/20/03
Format preferred for results:
Paper

Search Topic Information:

A battery comprising an anode and a cathode that are both carbon nanotubes wherein the carbon nanotube is selected from the group consisting of multi-walled nanotube and single-walled nanotube.

Special Instructions and Other Comments:

SCIENTIFIC REFERENCE BR.
Sci & Tech Inf. Ctr.
OCT 16 RECD
Pat. & T.M. Office



STIC Search Results Feedback Form

EIC17000

Questions about the scope or the results of the search? Contact *the EIC searcher* or contact:

Kathleen Fuller, EIC 1700 Team Leader
571/272-2505 REMSEN 4B28

Voluntary Results Feedback Form

- > I am an examiner in Workgroup: Example: 1713
> Relevant prior art found, search results used as follows:

- ☐ 102 rejection
- ☐ 103 rejection
- ☐ Cited as being of interest.
- ☐ Helped examiner better understand the invention.
- ☐ Helped examiner better understand the state of the art in their technology.

Types of relevant prior art found:

- ☐ Foreign Patent(s)
- ☐ Non-Patent Literature
(journal articles, conference proceedings, new product announcements etc.)

> Relevant prior art **not** found:

- ☐ Results verified the lack of relevant prior art (helped determine patentability).
- ☐ Results were not useful in determining patentability or understanding the invention.

Comments:

Drop off or send completed forms to EIC1700 REMSEN 4B28

=> d his full

(FILE 'HOME' ENTERED AT 11:45:22 ON 23 OCT 2006)

FILE 'REGISTRY' ENTERED AT 11:52:21 ON 23 OCT 2006

L1 1 SEA ABB=ON PLU=ON CARBON/CN
L2 1 SEA ABB=ON PLU=ON GRAPHITE/CN
L3 1 SEA ABB=ON PLU=ON LITHIUM/CN

FILE 'HCAPLUS' ENTERED AT 11:53:19 ON 23 OCT 2006

L4 4455789 SEA ABB=ON PLU=ON L1 OR L2 OR CARBON OR GRAPHITE OR C
L5 397713 SEA ABB=ON PLU=ON L3 OR LITHIUM OR LI
L6 35853 SEA ABB=ON PLU=ON CNT OR CARBON NANOTUBE# OR NANOTUBE#
L7 9345 SEA ABB=ON PLU=ON MWNT# OR SWNT# OR MULTI? WALL? (2A)
NANOTUBE# OR MULTIWALL? (2A) NANOTUBE# OR SINGLE? (2A)
WALL? NANOTUBE# OR SINGLEWALL? (2A) NANOTUBE#
L8 486 SEA ABB=ON PLU=ON L4 (L) L6 (L) BATTER?
L9 295 SEA ABB=ON PLU=ON L4 (L) L6 (L) BATTER? (L) L5
L10 62 SEA ABB=ON PLU=ON L4 (L) L6 (L) BATTER? (L) L5 (L)
CATHODE#
L11 146 SEA ABB=ON PLU=ON L4 (L) L6 (L) BATTER? (L) L5 (L)
ANODE#
L12 27 SEA ABB=ON PLU=ON L10 AND L11
L13 14 SEA ABB=ON PLU=ON L10 AND L7
L14 37 SEA ABB=ON PLU=ON L11 AND L7
L15 27 SEA ABB=ON PLU=ON L12 AND ELECTROCHEM?/SC,SX
L16 19 SEA ABB=ON PLU=ON L15 AND (1840-2003)/PRY,PY,AY
L17 43 SEA ABB=ON PLU=ON L13 OR L14
L18 41 SEA ABB=ON PLU=ON L17 AND ELECTROCHEM?/SC,SX
L19 21 SEA ABB=ON PLU=ON L18 AND (1840-2003)/PRY,PY,AY
L20 1 SEA ABB=ON PLU=ON 2004:1019587/AN
L21 20 SEA ABB=ON PLU=ON L20 OR L16
L22 15 SEA ABB=ON PLU=ON L19 NOT L21

=> file reg

FILE 'REGISTRY' ENTERED AT 12:17:35 ON 23 OCT 2006

USE IS SUBJECT TO THE TERMS OF YOUR STN CUSTOMER AGREEMENT.

PLEASE SEE "HELP USAGETERMS" FOR DETAILS.

COPYRIGHT (C) 2006 American Chemical Society (ACS)

=> d l21 que stat

L1 1 SEA FILE=REGISTRY ABB=ON PLU=ON CARBON/CN
L2 1 SEA FILE=REGISTRY ABB=ON PLU=ON GRAPHITE/CN
L3 1 SEA FILE=REGISTRY ABB=ON PLU=ON LITHIUM/CN
L4 4455789 SEA FILE=HCAPLUS ABB=ON PLU=ON L1 OR L2 OR CARBON OR
GRAPHITE OR C
L5 397713 SEA FILE=HCAPLUS ABB=ON PLU=ON L3 OR LITHIUM OR LI
L6 35853 SEA FILE=HCAPLUS ABB=ON PLU=ON CNT OR CARBON NANOTUBE#
OR NANOTUBE#
L10 62 SEA FILE=HCAPLUS ABB=ON PLU=ON L4 (L) L6 (L) BATTER?
(L) L5 (L) CATHODE#
L11 146 SEA FILE=HCAPLUS ABB=ON PLU=ON L4 (L) L6 (L) BATTER?
(L) L5 (L) ANODE#
L12 27 SEA FILE=HCAPLUS ABB=ON PLU=ON L10 AND L11
L15 27 SEA FILE=HCAPLUS ABB=ON PLU=ON L12 AND ELECTROCHEM?/SC,
SX
L16 19 SEA FILE=HCAPLUS ABB=ON PLU=ON L15 AND (1840-2003)/PRY,
PY,AY
L20 1 SEA FILE=HCAPLUS ABB=ON PLU=ON 2004:1019587/AN
L21 20 SEA FILE=HCAPLUS ABB=ON PLU=ON L20 OR L16

=> file hcaplus

FILE 'HCAPLUS' ENTERED AT 12:17:44 ON 23 OCT 2006

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=> d 121 1-20 ibib abs hitstr hitind
```

L21 ANSWER 1 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2006:1079963 HCAPLUS
TITLE: Rechargeable lithium battery
INVENTOR(S): Huang, Chuan-De
PATENT ASSIGNEE(S): Hon Hai Precision Industry Co., Ltd., Taiwan
SOURCE: Taiwan., 4pp.
CODEN: TWXXA5
DOCUMENT TYPE: Patent
LANGUAGE: Chinese
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
-----	---	-----	-----	
TW 238555	B1	20050821	TW 2003-92118395	200307 04
			<--	
RITY APPLN. INFO.:			TW 2003-92118395	200307 04

AB The present invention relates to a rechargeable **lithium battery** which includes an **anode**, a **cathode** and a porous separator disposed between the **anode** and the **cathode**. The **cathode** has a transitional metal oxide or sulfide as active material. The **anode** includes a conductive substrate, a layer of **carbon nanotubes** formed on the conductive substrate and a layer of **lithium metal** formed on the layer of **carbon nanotubes**. The **battery** of the present invention employs **lithium metal** as active material, thus it may improve the energy d. Furthermore, the sepn. of the **lithium metal** and the substrate avoids reaction between them and lengthens the lifetime of the **battery**.

IC ICM H01M010-36
ICS H01M004-00

CC 52 (**Electrochemical**, Radiational, and Thermal Energy Technology)

L21 ANSWER 2 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2006:782355 HCAPLUS
DOCUMENT NUMBER: 145:252335
TITLE: Manufacture of electrode and lithium secondary
battery using the electrode comprising
multi-walled carbon nanotube
INVENTOR(S): Choi, Sang Jin; Do, Chil Hun; Kang, Geun Yeong;
Mun, Seong In; Yoon, Mun Su
PATENT ASSIGNEE(S): Korea Electro Technology Research Institute, S.
Korea
SOURCE: Repub. Korean Kongkae Taeho Kongbo, No pp. given
CODEN: KRXXA7
DOCUMENT TYPE: Patent
LANGUAGE: Korean
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
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Ross Shipe EIC 1700 Remsen 4B31 571/272-6018

KR 2004084114 A 20041006 KR 2003-18942

200303
26

PRIORITY APPLN. INFO.:

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KR 2003-18942

200303
26

<--
AB Provided is a lithium secondary battery using an electrode comprising a multi-walled carbon nanotube which has high specific capacity and improved energy characteristic by the reversible adsorption and desorption of lithium ion. A method for manufg. the electrode is also provided. The electrode is manufd. by mixing a multi-walled carbon nanotube material with a binder and a dispersion medium to obtain an electrode mixt.; applying the electrode mixt. onto a collector, and drying. The battery has an anode composed of the above electrode; a cathode comprising a transition metal compd. material; a multiporous separator which is lithium ion-conductible and electron-nonconductible; and a lithium salt conduction medium.

IC ICM H01M004-04

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST manuf anode lithium secondary battery
carbon nanotube

IT Nanotubes
(carbon; manuf. of anodes contg. multi-walled carbon nanotube materials for secondary lithium batteries)

IT Secondary batteries
(lithium; manuf. of anodes contg. multi-walled carbon nanotube materials for secondary lithium batteries)

IT Battery anodes
(manuf. of anodes contg. multi-walled carbon nanotube materials for secondary lithium batteries)

L21 ANSWER 3 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2005:1116683 HCAPLUS

DOCUMENT NUMBER: 143:463074

TITLE: Carbon nanotube lithium secondary battery

INVENTOR(S): Huang, Quande

PATENT ASSIGNEE(S): Hongfujin Precision Industry Shenzhen Co., Ltd.,
Peop. Rep. China; Hon Hai Precision Industry Co., Ltd.

SOURCE: Faming Zhuanli Shenqing Gongkai Shuomingshu, 6
pp.

CODEN: CNXXEV

DOCUMENT TYPE: Patent

LANGUAGE: Chinese

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
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CN 1567615	A	20050119	CN 2003-139734	

200307
02

PRIORITY APPLN. INFO.:

<--
CN 2003-139734

200307
02

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AB This invention relates to a **carbon nanotube lithium secondary battery**, which comprises a **cathode** contg. active materials of transition-metal oxide or sulfide, an **anode**, and a porous barrier membrane disposed between the **anode** and the **cathode**, wherein the **anode** includes a conductive substrate, a **carbon nanotube** layer formed on the surface of the substrate, and a **lithium** layer formed on the surface of the **carbon nanotube** layer. This invention fully utilizes the advantage of high energy d. of **lithium**, and prevents the reaction caused by the direct contact between **lithium** and the substrate, resulting in prolonged service life of the **battery** and increased elec. capacity.

IT 7440-44-0, Carbon, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(nanotubes; carbon nanotube
lithium secondary battery anode)

RN 7440-44-0 HCAPLUS

CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

IC ICM H01M004-02
ICS H01M004-36; H01M002-16; H01M010-36

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST carbon nanotube anode lithium secondary battery

IT Nanotubes
(carbon; carbon nanotube
lithium secondary battery anode)

IT Battery anodes
(lithium battery; carbon
nanotube as conductors for)

IT 7440-44-0, Carbon, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(nanotubes; carbon nanotube
lithium secondary battery anode)

L21 ANSWER 4 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2005:467699 HCAPLUS

DOCUMENT NUMBER: 143:29421

TITLE: Lithium-ion battery

INVENTOR(S): Chen, Jieliang; Lu, Changyue

PATENT ASSIGNEE(S): Hongfujin Precision Industry Shenzhen Co. Ltd.,
Peop. Rep. China

SOURCE: Faming Zhuanli Shenqing Gongkai Shuomingshu, No
pp. given
CODEN: CNXXEV

DOCUMENT TYPE: Patent

LANGUAGE: Chinese

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
-----	----	-----	-----	

CN 1516304	A	20040728	CN 2003-113512	200301 03

<--

PRIORITY APPLN. INFO.:

CN 2003-113512

200301
03

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AB This battery has a cathode, an anode and a permeation isolation film. The cathode contains nano-sized LixCoyNizO2 particles, the anode consists of C nanotubes, each multi-walled C nanotube contains many coaxial graphite tube layers, and Li ions can be embedded between adjacent graphite tube layers. The nano LixCoyNizO2 particles have a large sp. surface area and high chem. activity which increase battery capacity.

IT 7440-44-0, Carbon, uses
RL: DEV (Device component use); USES (Uses)
(nanotubes, anode contg.; anode and cathode material for lithium-ion batteries)

RN 7440-44-0 HCAPLUS

CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

IC ICM H01M004-58

ICS H01M004-48; H01M010-36

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

IT Nanotubes
(carbon, anode contg.; anode and cathode material for lithium-ion batteries)

IT 7440-44-0, Carbon, uses
RL: DEV (Device component use); USES (Uses)
(nanotubes, anode contg.; anode and cathode material for lithium-ion batteries)

L21 ANSWER 5 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2004:1019587 HCAPLUS

DOCUMENT NUMBER: 141:426330

TITLE: Novel carbon nanotube lithium battery

INVENTOR(S): Morris, Robert Scott; Dixon, Brian Gilbert

PATENT ASSIGNEE(S): Phoenix Innovation, Inc., USA

SOURCE: U.S. Pat. Appl. Publ., 13 pp.

CODEN: USXXCO

DOCUMENT TYPE: Patent

LANGUAGE: English

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
US 2004234844	A1	20041125	US 2003-668976	20030923
WO 2005022666	A2	20050310	WO 2004-US15767	20040520

W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD,

SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ,
 VC, VN, YU, ZA, ZM, ZW
 RW: BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW,
 AM, AZ, BY, KG, KZ, MD, RU, TJ, TM, AT, BE, BG, CH, CY, CZ,
 DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PL,
 PT, RO, SE, SI, SK, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ,
 GW, ML, MR, NE, SN, TD, TG

EP 1656709 A2 20060517 EP 2004-776053

200405
 20

R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC,
 PT, IE, SI, LT, LV, FI, RO, MK, CY, AL, TR, BG, CZ, EE, HU,
 PL, SK, HR

PRIORITY APPLN. INFO.:

US 2003-471780P

P

200305
 20

US 2003-668976

A

200309
 23

WO 2004-US15767

W

200405
 20

AB This simplified self-powered attitude indicator gives a visual
 indication of aircraft attitude and has suitable indicators and
 operational alarms. The indicator is self-powered and readily
 transferable between aircraft. This indicator does not replace the
 std. gyroscopic indicator, but supplements it.

IC ICM H01M006-00

INCL 429122000

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

L21 ANSWER 6 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2004:987579 HCAPLUS

DOCUMENT NUMBER: 142:201502

TITLE: Manufacture of anode for secondary lithium
 battery and the battery

INVENTOR(S): Choi, Sang Jin; Do, Chil Hun; Mun, Seong In

PATENT ASSIGNEE(S): Korea Electro Technology Research Institute, S.
 Korea

SOURCE: Repub. Korean Kongkae Taeho Kongbo, No pp. given
 CODEN: KRXXA7

DOCUMENT TYPE: Patent

LANGUAGE: Korean

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
-----	----	-----	-----	
KR 2003092902	A	20031206	KR 2002-30748	

200205
 31

PRIORITY APPLN. INFO.:

KR 2002-30748

200205
 31

AB The anode is prepd. by mixing multi-wall C
 nanotubes with a binder and a dispersing medium, applying
 the mixt. on a collector, and drying. The coated collector may be
 compressed. A secondary lithium battery use the
 anode and a transition metal compd. cathode.
 IT 7440-44-0, Carbon, uses

RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process); USES (Uses)

(manuf. of multi-wall carbon nanotube anodes for secondary lithium batteries)

RN 7440-44-0 HCAPLUS

CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

IC ICM H01M004-02

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST secondary lithium battery multiwall carbon nanotube anode manuf

IT Nanotubes

(carbon; manuf. of multi-wall carbon nanotube anodes for secondary lithium batteries)

IT Battery anodes

(manuf. of multi-wall carbon nanotube anodes for secondary lithium batteries)

IT 7440-44-0, Carbon, uses

RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PYP (Physical process); PROC (Process); USES (Uses)

(manuf. of multi-wall carbon nanotube anodes for secondary lithium batteries)

L21 ANSWER 7 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2004:970631 HCAPLUS

DOCUMENT NUMBER: 142:180388

TITLE: Lithium secondary batteries with carbon nanotubes as conducting material

INVENTOR(S): Han, Yeong Su; Shin, Jin Guk

PATENT ASSIGNEE(S): Lg Electronics Inc., S. Korea

SOURCE: Repub. Korean Kongkae Taeho Kongbo, No pp. given
CODEN: KRXXA7

DOCUMENT TYPE: Patent

LANGUAGE: Korean

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
-----	---	-----	-----	
KR 2003013553	A	20030215	KR 2001-47618	20010808

PRIORITY APPLN. INFO.:

<--
KR 2001-47618

20010808

AB This secondary battery has an improved discharge capacity and an enhanced rate capability by using C nanotubes as conducting material. The battery comprises a cathode, an electrolyte and an anode, wherein C nanotubes are used as a conducting material providing a pathway for reactants and electrons. The C nanotubes can be replaced by C

nanowires or C nanoparticles. Optionally a mixt. of C nanotubes and C black is used as a conducting material. Preferably the secondary battery is a Li-S battery, a Li-FeS battery, a Li-Ti₂S battery and a Li-organosulfur battery, or a Li-based secondary battery comprising a Li-ion battery, a Li polymer battery and a Li-MnO₂ battery.

IC ICM H01M010-02

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

L21 ANSWER 8 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2004:857824 HCAPLUS

DOCUMENT NUMBER: 141:352740

TITLE: Surfactant-treated lithium battery electrodes for improved solid electrolyte interface during cycling

INVENTOR(S): Morris, Robert Scott; Dixon, Brian Gilbert

PATENT ASSIGNEE(S): Phoenix Innovations, Inc., USA

SOURCE: PCT Int. Appl., 21 pp.

CODEN: PIXXD2

DOCUMENT TYPE: Patent

LANGUAGE: English

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
WO 2004088769	A2	20041014	WO 2004-US3750	20040209

<--

WO 2004088769 A3 20050203

W: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW

RW: BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW, AM, AZ, BY, KG, KZ, MD, RU, TJ, TM, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR, BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG

EP 1597783 A2 20051123 EP 2004-709487

20040209

<--

R: AT, BE, CH, DE, DK, ES, FR, GB, GR, IT, LI, LU, NL, SE, MC, PT, IE, SI, LT, LV, FI, RO, MK, CY, AL, TR, BG, CZ, EE, HU, SK

JP 2006520082 T2 20060831 JP 2006-508704

20040209

<--

PRIORITY APPLN. INFO.: US 2003-447500P

P

20030219

<--

WO 2004-US3750

W

20040209

AB Novel lithium batteries with improved interfacial contact and decreased impedance between the electrolyte and the electrodes, resulting in improved safety (esp. to prevent overcharging during cycling) are characterized by having one or both surfactant-modified electrodes, a porous separator, and an electrolyte. The anode is esp. a carbon anode (e.g., graphite, mesocarbon microbeads, buckyballs, and multiwall and single-walled carbon nanotubes) that is coated with a fluorinated, nonionic, or cationic surfactant; the cathode is esp. a lithium metal oxide (e.g., LiNiCoO₂, LiCoO₂, LiNO₂, and LiMnO₂) coated with a fluorinated, dimeric, cationic, or nonionic surfactant. All the surfactants have an incorporated reactive end group of various reactive functionality (e.g., vinyl, allyl, acrylate, propargyl, diene, polyene, etc). The electrolytes include nonaq. org. electrolytes and can incorporate added lithium salts.

IC ICM H01M

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

Section cross-reference(s): 46

L21 ANSWER 9 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2004:550617 HCAPLUS

DOCUMENT NUMBER: 141:91858

TITLE: Lithium ion battery comprising nanomaterials

INVENTOR(S): Chen, Ga-Lane; Leu, Charles

PATENT ASSIGNEE(S): Hon Hai Precision Ind. Co., Ltd., Taiwan

SOURCE: U.S. Pat. Appl. Publ., 5 pp.

CODEN: USXXCO

DOCUMENT TYPE: Patent

LANGUAGE: English

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
US 2004131937	A1	20040708	US 2003-404467	20030331
			<--	
US 7060390	B2	20060613		
TW 236778	B1	20050721	TW 2003-92100154	20030106
			<--	
JP 2004214162	A2	20040729	JP 2003-106946	20030410
			<--	
US 2006204853	A1	20060914	US 2005-293341	20051202
			<--	
			TW 2003-92100154	20030106
			<--	
			US 2003-404467	20030331
			<--	

PRIORITY APPLN. INFO.:

AB A lithium ion battery includes a cathode having a plurality of nanoparticles of lithium doped transition metal alloy oxides represented by the formula

LixCoyNizO2, an anode having at least one carbon nanotube array, an electrolyte, and a membrane sepg. the anode from the cathode. The carbon nanotube array includes a plurality of multi-walled carbon nanotubes. Preferably, an av. diam. of an outermost wall of the multi-walled carbon nanotubes is in the range from 10 to 100 nm, and a pitch between adjacent multi-walled carbon nanotubes is in the range from 20 to 500 nm. In the carbon nanotube array, the lithium ions are able to intercalate not only inside the multi-walled carbon nanotubes, but also in the interstices between adjacent multi-walled carbon nanotubes. Thus a d. of intercalation of the carbon nanotube array is significantly higher than that of graphite.

IC ICM H01M004-58

ICS H01M004-52

INCL 429231800; X42-922.3; X42-923.13

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

REFERENCE COUNT: 7 THERE ARE 7 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L21 ANSWER 10 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2003:910341 HCAPLUS

DOCUMENT NUMBER: 139:397965

TITLE: Lithium secondary battery made with carbon nanotube for high output and high capacity without short circuit

INVENTOR(S): Kumashiro, Yoshiaki; Okumura, Takefumi; Kasai, Masahiro

PATENT ASSIGNEE(S): Hitachi Ltd., Japan

SOURCE: Jpn. Kokai Tokkyo Koho, 8 pp.

CODEN: JKXXAF

DOCUMENT TYPE: Patent

LANGUAGE: Japanese

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
-----	---	-----	-----	
JP 2003331838	A2	20031121	JP 2002-137899	200205 14

PRIORITY APPLN. INFO.: <-- JP 2002-137899

200205
14

AB The Li secondary battery has cathode made with carbon nanotube as elec. conductor, anode made from carbon nanotube, and a gel-form electrolyte contg. polymer, nonaq. electrolyte and alkali metal salt. The cathode material contains compd. oxides, and the anode material contains graphite, amorphous C, Si or Si oxide.

IT 7440-44-0, Carbon, uses

RL: TEM (Technical or engineered material use); USES (Uses)
(amorphous, anode contg.; lithium secondary battery made with carbon nanotube for high output and high capacity without short circuit)

RN 7440-44-0 HCAPLUS

CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

IT 7782-42-5, Graphite, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(anode contg.; lithium secondary
battery made with carbon nanotube for
high output and high capacity without short circuit)
RN 7782-42-5 HCAPLUS
CN Graphite (8CI, 9CI) (CA INDEX NAME)

C

IC ICM H01M004-58
ICS H01M004-02; H01M004-38; H01M004-48; H01M004-62; H01M010-40
CC 52-2 (Electrochemical, Radiational, and Thermal Energy
Technology)
IT 7440-44-0, Carbon, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(amorphous, anode contg.; lithium secondary
battery made with carbon nanotube for
high output and high capacity without short circuit)
IT 7440-21-3, Silicon, uses 7631-86-9, Silica, uses 7782-42-5
, Graphite, uses
RL: TEM (Technical or engineered material use); USES (Uses)
(anode contg.; lithium secondary
battery made with carbon nanotube for
high output and high capacity without short circuit)
IT 12031-65-1, Lithium nickel oxide (LiNiO₂) 12190-79-3,
Cobalt lithium oxide (LiCoO₂)
RL: TEM (Technical or engineered material use); USES (Uses)
(cathode active material; lithium secondary
battery made with carbon nanotube for
high output and high capacity without short circuit)

L21 ANSWER 11 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2003:675727 HCAPLUS
DOCUMENT NUMBER: 139:182903
TITLE: Secondary lithium battery
INVENTOR(S): Tsushima, Manabu; Morimoto, Takeshi
PATENT ASSIGNEE(S): Asahi Glass Co., Ltd., Japan
SOURCE: Jpn. Kokai Tokkyo Koho, 4 pp.
CODEN: JKXXAF
DOCUMENT TYPE: Patent
LANGUAGE: Japanese
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 2003242975	A2	20030829	JP 2002-38408	20020215
PRIORITY APPLN. INFO.:				20020215

AB The battery has an activated C based
cathode, a Li intercalating carbonaceous
anode, and a Li salt contg. org. electrolyte
soln.; where the carbonaceous material for the anode is

C nanotubes. Preferably, the **nanotubes** have diam. 0.7-20 nm.

IT 7440-44-0, **Carbon**, uses
 RL: DEV (Device component use); USES (Uses)
 (nanotubes; lithium intercalating
 carbon nanotube anodes for secondary
 lithium batteries)

RN 7440-44-0 HCAPLUS

CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

IC ICM H01M004-58
 ICS H01G009-058; H01M004-02; H01M010-40

CC 52-2 (Electrochemical, Radiational, and Thermal Energy
 Technology)

ST secondary lithium battery anode
 carbon nanotube

IT Nanotubes
 (carbon; lithium intercalating carbon
 nanotube anodes for secondary lithium
 batteries)

IT Battery anodes
 (lithium intercalating carbon
 nanotube anodes for secondary lithium
 batteries)

IT 7440-44-0, **Carbon**, uses
 RL: DEV (Device component use); USES (Uses)
 (nanotubes; lithium intercalating
 carbon nanotube anodes for secondary
 lithium batteries)

L21 ANSWER 12 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2003:458493 HCAPLUS

DOCUMENT NUMBER: 139:216878

TITLE: Effect of Multiwalled Carbon Nanotubes on
 Electrochemical Properties of Lithium/Sulfur
 Rechargeable Batteries

AUTHOR(S): Han, Sang-Cheol; Song, Min-Sang; Lee, Ho; Kim,
 Hyun-Seok; Ahn, Hyo-Jun; Lee, Jai-Young

CORPORATE SOURCE: Department of Materials Science and Engineering,
 Korea Advanced Institute of Science and
 Technology, Daejeon, 305-701, S. Korea

SOURCE: Journal of the Electrochemical Society (
 2003), 150(7), A889-A893
 CODEN: JESQAN; ISSN: 0013-4651

PUBLISHER: Electrochemical Society

DOCUMENT TYPE: Journal

LANGUAGE: English

AB To bestow high electronic cond. and prevent dissoln. of sulfur into
 the electrolyte, multi-walled **carbon nanotubes**
 (MWNTs) were prepd. by thermal CVD as an inactive additive material
 for elemental sulfur pos. electrodes for lithium/sulfur
 rechargeable **batteries**. The initial discharge capacity of
 elemental sulfur pos. electrode with MWNT is 485 mAh/g sulfur at 2.0
 V vs. Li/Li+. The cycle life and rate
 capability of sulfur **cathode** is increased with addn. of
 MWNT. The MWNT shows a vital role on polysulfide adsorption and is
 a good elec. conductor for a sulfur **cathode**.

IT 7439-93-2, **Lithium**, uses
 RL: DEV (Device component use); USES (Uses)
 (foil, anode; effect of multi-walled **carbon**
 nanotubes on electrochem. properties of lithium
 /sulfur rechargeable **batteries**)

RN 7439-93-2 HCAPLUS
 CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 49, 76
 IT Battery cathodes
 Cyclic voltammetry
 Electric conductivity
 Electric current-potential relationship
 (effect of multi-walled carbon nanotubes on electrochem. properties of lithium/sulfur rechargeable batteries)

IT 7439-93-2, Lithium, uses
 RL: DEV (Device component use); USES (Uses)
 (foil, anode; effect of multi-walled carbon nanotubes on electrochem. properties of lithium/sulfur rechargeable batteries)

IT 7429-90-5, Aluminum, uses
 RL: DEV (Device component use); USES (Uses)
 (foil, cathode substrate; effect of multi-walled carbon nanotubes on electrochem. properties of lithium/sulfur rechargeable batteries)

REFERENCE COUNT: 17 THERE ARE 17 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L21 ANSWER 13 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2003:437474 HCAPLUS

DOCUMENT NUMBER: 139:263178

TITLE: Development and testing of nanomaterials for rechargeable lithium batteries

AUTHOR(S): Odani, A.; Nimberger, A.; Markovsky, B.; Sominski, E.; Levi, E.; Kumar, V. G.; Motiei, M.; Gedanken, A.; Dan, P.; Aurbach, D.

CORPORATE SOURCE: Department of Chemistry, Bar-Ilan University, Ramat Gan, 52900, Israel

SOURCE: Journal of Power Sources (2003), 119-121, 517-521

CODEN: JPSODZ; ISSN: 0378-7753

PUBLISHER: Elsevier Science B.V.

DOCUMENT TYPE: Journal

LANGUAGE: English

AB The use of nanoparticles in composite electrodes for Li batteries has kinetic advantages due to the redn. of the diffusion length for Li insertion in the active mass, and also because of the redn. of the overall charge transfer resistance of the electrodes. The synthesis of various types of nanomaterials for rechargeable Li batteries and their testing as active mass in anodes and cathodes are reported. These include SnO, VOx, LixMnO2, and various types of C nanotubes. Sonochem. was applied for the synthesis of part of the nanophases. The tools for this study included XRD, TEM, DSC, and the electrochem. techniques CV, SSCV, chronopotentiometry and impedance spectroscopy.

IT 7440-44-0P, Carbon, uses
 RL: DEV (Device component use); PNU (Preparation, unclassified); PREP (Preparation); USES (Uses)
 (nanotubes; carbon nanomaterials as anodes for rechargeable lithium batteries)

RN 7440-44-0 HCAPLUS

CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

Section cross-reference(s): 72

IT Nanotubes

(carbon; carbon nanomaterials as anodes for rechargeable lithium batteries)

IT 7440-44-0P, Carbon, uses

RL: DEV (Device component use); PNU (Preparation, unclassified);

PREP (Preparation); USES (Uses)

(nanotubes; carbon nanomaterials as anodes for rechargeable lithium batteries)

REFERENCE COUNT: 16 THERE ARE 16 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L21 ANSWER 14 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2003:413936 HCAPLUS

DOCUMENT NUMBER: 138:371788

TITLE: Lithium-ion battery with electrodes including single wall carbon nanotubes

INVENTOR(S): Ochoa, Rosibel; Kerzhner-Haller, Inna; Maleki, Hossein

PATENT ASSIGNEE(S): USA

SOURCE: U.S. Pat. Appl. Publ., 6 pp.

CODEN: USXXCO

DOCUMENT TYPE: Patent

LANGUAGE: English

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
US 2003099883	A1	20030529	US 2001-974283	20011010

PRIORITY APPLN. INFO.:

US 2001-974283

AB A lithium-ion battery that includes a plurality of electrodes, such as an anode and cathode, and at least one of the plurality of electrodes is made of a conductive material having a single wall fullerene-carbon nanotube additive. The use of single wall carbon nanotubes as an additive in the electrode materials, even in very small amts., improves the capacity, thermal stability, and safety of the electrode materials.

IC ICM H01M004-62

ICS H01M004-52

INCL 429232000; 429231100; 429231300; 429223000

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

L21 ANSWER 15 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2003:169072 HCAPLUS

DOCUMENT NUMBER: 138:387954

TITLE: Application of nanotechnology to lithium secondary batteries
AUTHOR(S): Wu, Yu-ping; Elke, Rahm; Rudolf, Holze
CORPORATE SOURCE: Department of Electrochemistry, Institute of Chemistry, Chemnitz University of Technologies, Chemnitz, 09107, Germany
SOURCE: Dianchi (2002), 32(6), 350-353
CODEN: DNCHEP; ISSN: 1001-1579
PUBLISHER: Dianchi Zazhishe
DOCUMENT TYPE: Journal; General Review
LANGUAGE: Chinese

AB A review of nanotechnol. pertaining to sol-gel methods, template methods, discharge of C bar, and mech. milling, as applicable to Li secondary batteries. With these nanotechnologies, cathodes, anodes and other materials were prepd. for Li batteries. The cathode materials include Li Co oxides, Li Ni oxides, Li Mn oxides, V oxides and the anode materials include carbonaceous materials, C nanotubes, Sn oxides, and metallic anodes. Examples of other nanomaterials are polymer electrolytes and conductive agents. All of these nanomaterials performed better electrochem. than those prepd. by traditional methods. Theor. research on nanotechnologies as applied to Li secondary batteries, is needed. With the development of nanotechnol., micro Li batteries will be manufd. in the future.

CC 52-0 (Electrochemical, Radiational, and Thermal Energy Technology)

L21 ANSWER 16 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2002:881125 HCAPLUS
DOCUMENT NUMBER: 138:240533
TITLE: Block Copolymer-Templated Nanocomposite Electrodes for Rechargeable Lithium Batteries
AUTHOR(S): Mui, S. C.; Trapa, P. E.; Huang, B.; Soo, P. P.; Lozow, M. I.; Wang, T. C.; Cohen, R. E.; Mansour, A. N.; Mukerjee, S.; Mayes, A. M.; Sadoway, D. R.
CORPORATE SOURCE: Massachusetts Institute of Technology, Department of Materials Science and Engineering, Cambridge, MA, 02139-4307, USA
SOURCE: Journal of the Electrochemical Society (2002), 149(12), A1610-A1615
CODEN: JESOAN; ISSN: 0013-4651
PUBLISHER: Electrochemical Society
DOCUMENT TYPE: Journal
LANGUAGE: English

AB A self-organizing, nanocomposite electrode (SONE) system was developed as a model lithium alloy-based anode for rechargeable lithium batteries. In situ x-ray adsorption spectroscopy, galvanostatic testing, cyclic voltammetry, x-ray diffraction, and TEM were used to analyze the electrode, which was fabricated from a polyethylene oxide-based block copolymer, single-walled carbon nanotubes, and gold salt. Processing involved a single mixing step without need of a reducing agent. Thermodyn. self-assembly of the block copolymer could provide a template for incorporation of both the gold salt and nanotubes. Electrochem. testing and subsequent anal. showed that owing to the small particle size and the surrounding block copolymer matrix, the SONE system could cycle over 600 cycles with rates varying between C/1.8 and 8.8 C with little evidence of decrepitation or coarsening.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

Section cross-reference(s): 38

ST block copolymer template nanocomposite electrode rechargeable
lithium battery; carbon nanotube
methacrylate copolymer composite film lithium gold
cathode

IT Nanotubes
(carbon, single-walled, acid-treated, solvent cast
composite film with POEM-b-PMMA, and lithium-gold salt,
cathode; block copolymer-templated nanocomposite
electrodes for rechargeable lithium batteries
)

IT Battery anodes
(composite with carbon nanotubes and gold
salt, cathode; block copolymer-templated nanocomposite
electrodes for rechargeable lithium batteries
)

IT 127691-09-2P
RL: DEV (Device component use); PRP (Properties); SPN (Synthetic
preparation); TEM (Technical or engineered material use); PREP
(Preparation); USES (Uses)
(block copolymer, solvent cast composite film with carbon
nanotubes, and lithium-gold salt,
cathode; block copolymer-templated nanocomposite
electrodes for rechargeable lithium batteries
)

IT 502169-73-5
RL: DEV (Device component use); PRP (Properties); USES (Uses)
(solvent cast composite film with POEM-b-PMMA, and carbon
nanotubes, cathode; block copolymer-templated
nanocomposite electrodes for rechargeable lithium
batteries)

REFERENCE COUNT: 66 THERE ARE 66 CITED REFERENCES AVAILABLE
FOR THIS RECORD. ALL CITATIONS AVAILABLE
IN THE RE FORMAT

L21 ANSWER 17 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2002:870729 HCAPLUS
DOCUMENT NUMBER: 138:194879
TITLE: A feasibility study of scaling-up the
electrolytic production of carbon nanotubes in
molten salts
AUTHOR(S): Dimitrov, Aleksandar T.; Chen, George Z.;
Kinloch, Ian A.; Fray, Derek J.
CORPORATE SOURCE: Department of Material Science and Metallurgy,
University of Cambridge, Cambridge, CB2 3QZ, UK
SOURCE: Electrochimica Acta (2002), 48(1),
91-102
CODEN: ELCAAV; ISSN: 0013-4686
PUBLISHER: Elsevier Science Ltd.
DOCUMENT TYPE: Journal
LANGUAGE: English

AB The feasibility of scaling-up the electrolytic prodn. of
carbon nanotubes in molten salts has been
investigated with the aid of electron microscopy (TEM and SEM).
Using molten LiCl as the electrolyte and com. graphite as
both cathode and anode materials, carbon
nanomaterials, including nanotubes, were prepd. by const.
voltage electrolysis. The cell was more than 20 times as large as
that used in previous work. The nanotube concn. in the
final product increased with cell voltage (including iR drop) from 1
vol. % at 4.0 V to 35 vol. % at 8.4 V. Under desired conditions,
the charge and energy consumption for the cathode erosion
was 0.28 Ah/g and 4.1 Wh/g, of which 60-70 wt. % were for producing
nanomaterials (nanotubes: >30 vol. %). When adding 1 wt.
% SnCl₂ to the electrolyte, partial and fully filled
nanotubes were obtained with the nanomaterials contg. up to
20 wt.% Sn. Preliminary results from applying the product as the

electrode in lithium ion batteries are reported.

CC 72-2 (Electrochemistry)

Section cross-reference(s): 52

REFERENCE COUNT: 20 THERE ARE 20 CITED REFERENCES AVAILABLE
FOR THIS RECORD. ALL CITATIONS AVAILABLE
IN THE RE FORMAT

L21 ANSWER 18 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 1999:658669 HCAPLUS

DOCUMENT NUMBER: 131:274220

TITLE: Organic electrolyte batteries with lithium
manganese oxide cathode active materials

INVENTOR(S): Fukunaga, Takao

PATENT ASSIGNEE(S): Japan Storage Battery Co., Ltd., Japan

SOURCE: Jpn. Kokai Tokkyo Koho, 6 pp.

CODEN: JKXXAF

DOCUMENT TYPE: Patent

LANGUAGE: Japanese

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
-----	----	-----	-----	
JP 11283629	A2	19991015	JP 1998-100037	199803 27

PRIORITY APPLN. INFO.:

JP 1998-100037

199803
27

AB The batteries consist of a cathode comprising
Mn-based Li mixed oxide active material, C
nanotube elec. conductor, and a binder; an anode;
and an org. electrolyte. The batteries are suitable for
use in elec. automobiles, portable elec. app., e.g. laptop computer,
liq. crystal TV, etc.

IC ICM H01M004-62

ICS H01M004-02; H01M010-40

CC 52-2 (Electrochemical, Radiational, and Thermal Energy
Technology)

ST lithium manganese oxide org battery
cathode; carbon nanotube conductor
battery cathode

IT Nanotubes

RL: DEV (Device component use); USES (Uses)
(carbon, elec. conductor in cathode; org.
electrolyte batteries with cathodes
comprising lithium manganese oxide and carbon
nanotube)

IT Battery cathodes

(org. electrolyte batteries with cathodes
comprising lithium manganese oxide and carbon
nanotube)

IT 12057-17-9, Lithium manganese oxide (LiMn2O4)

RL: DEV (Device component use); USES (Uses)
(cathode active material; org. electrolyte
batteries with cathodes comprising
lithium manganese oxide and carbon
nanotube)

L21 ANSWER 19 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 1997:247511 HCAPLUS

DOCUMENT NUMBER: 126:227671

TITLE: Anodes for nonaqueous secondary batteries and

INVENTOR(S): batteries using them
Nitsuta, Yoshiaki; Shimamura, Harunari; Okamura,
Kazuhiro
PATENT ASSIGNEE(S): Matsushita Electric Ind Co Ltd, Japan
SOURCE: Jpn. Kokai Tokkyo Koho, 5 pp.
CODEN: JKXXAF
DOCUMENT TYPE: Patent
LANGUAGE: Japanese
FAMILY ACC. NUM. COUNT: 1
PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 09045312	A2	19970214	JP 1995-194563	199507 31

PRIORITY APPLN. INFO.: <-- JP 1995-194563
199507
31

AB Claimed **anodes** comprise **carbon nanotube**
comps. having spacing of d(002) 0.34 nm and opening at the both
ends, which contain 10-100 ppm ≥ 1 of Li, Na, K, Mg,
and Ca in hollow area. **Batteries** comprise the
anodes and **Li-intercalating cathodes** are
also claimed. The **batteries** prevent Li dendrite
growth and have high capacity.
IT 7439-93-2, Lithium, uses
RL: MOA (Modifier or additive use); USES (Uses)
(**anodes** contg. doped **carbon nanotube**
for nonaq. **batteries**)
RN 7439-93-2 HCAPLUS
CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

IC ICM H01M004-02
ICS C01B031-02; H01M004-58; H01M010-40
CC 52-2 (Electrochemical, Radiational, and Thermal Energy
Technology)
ST **anode carbon nanotube lithium**
battery; **alkali metal carbon nanotube**
anode; **alk earth carbon nanotube**
anode
IT Secondary **batteries**
(**lithium**; **anodes** contg. doped **carbon**
nanotube for nonaq. **batteries**)
IT 7439-93-2, Lithium, uses 7439-95-4, Magnesium,
uses 7440-09-7, Potassium, uses 7440-23-5, Sodium, uses
7440-70-2, Calcium, uses
RL: MOA (Modifier or additive use); USES (Uses)
(**anodes** contg. doped **carbon nanotube**
for nonaq. **batteries**)

L21 ANSWER 20 OF 20 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 1995:453440 HCAPLUS

DOCUMENT NUMBER: 122:192537

TITLE: Battery electrode matrix and batteries with

nonaqueous electrolyte

INVENTOR(S): Tabuchi, Junji; Shohata, Nobuaki; Numata,
Tatsuji

PATENT ASSIGNEE(S): Nippon Electric Co, Japan

SOURCE: Jpn. Kokai Tokkyo Koho, 5 pp.
 CODEN: JKXXAF
 DOCUMENT TYPE: Patent
 LANGUAGE: Japanese
 FAMILY ACC. NUM. COUNT: 1
 PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 07014582	A2	19950117	JP 1993-175929	19930624
JP 2513418	B2	19960703	JP 1993-175929	19930624

AB The matrix comprises **cathode** active materials, binder, and conducting agent of carbonaceous materials contg. **carbon nanotubes** or those contg. metal ions. **Batteries** comprising the matrix, Li-absorbable **anodes**, and nonaq. solvent electrolytes are also claimed. Internal resistance of the **batteries** are decreased by use of **carbon nanotubes**.

IT 7439-93-2, Lithium, uses
 RL: DEV (Device component use); USES (Uses)
 (anode; **battery cathodes** contg.
 (metal-contg.) **carbon nanotubes** and
batteries)

RN 7439-93-2 HCAPLUS

CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

IC ICM H01M004-62

ICS H01M004-02; H01M010-40

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

IT Lithium alloy, base

RL: DEV (Device component use); USES (Uses)
 (battery cathodes contg. (metal-contg.)
carbon nanotubes and **batteries**)

IT 7439-93-2, Lithium, uses

RL: DEV (Device component use); USES (Uses)
 (anode; **battery cathodes** contg.
 (metal-contg.) **carbon nanotubes** and
batteries)

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 L4 4455789 SEA FILE=HCAPLUS ABB=ON PLU=ON L1 OR L2 OR CARBON OR

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OR NANOTUBE#

L7 9345 SEA FILE=HCAPLUS ABB=ON PLU=ON MWNT# OR SWNT# OR
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OR SINGLE? (2A) WALL? NANOTUBE# OR SINGLEWALL? (2A)
NANOTUBE#

L10 62 SEA FILE=HCAPLUS ABB=ON PLU=ON L4 (L) L6 (L) BATTER?
(L) L5 (L) CATHODE#

L11 146 SEA FILE=HCAPLUS ABB=ON PLU=ON L4 (L) L6 (L) BATTER?
(L) L5 (L) ANODE#

L12 27 SEA FILE=HCAPLUS ABB=ON PLU=ON L10 AND L11

L13 14 SEA FILE=HCAPLUS ABB=ON PLU=ON L10 AND L7

L14 37 SEA FILE=HCAPLUS ABB=ON PLU=ON L11 AND L7

L15 27 SEA FILE=HCAPLUS ABB=ON PLU=ON L12 AND ELECTROCHEM?/SC,
SX

L16 19 SEA FILE=HCAPLUS ABB=ON PLU=ON L15 AND (1840-2003)/PRY,
PY,AY

L17 43 SEA FILE=HCAPLUS ABB=ON PLU=ON L13 OR L14

L18 41 SEA FILE=HCAPLUS ABB=ON PLU=ON L17 AND ELECTROCHEM?/SC,
SX

L19 21 SEA FILE=HCAPLUS ABB=ON PLU=ON L18 AND (1840-2003)/PRY,
PY,AY

L20 1 SEA FILE=HCAPLUS ABB=ON PLU=ON 2004:1019587/AN

L21 20 SEA FILE=HCAPLUS ABB=ON PLU=ON L20 OR L16

L22 15 SEA FILE=HCAPLUS ABB=ON PLU=ON L19 NOT L21

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FILE 'HCAPLUS' ENTERED AT 12:18:46 ON 23 OCT 2006

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=> d l22 1-15 ibib abs hitstr hitind

L22 ANSWER 1 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2003:677093 HCAPLUS

DOCUMENT NUMBER: 140:7031

TITLE: Electron diffraction and X-ray studies of new
LiC10 and LiC8 structures in chemically
lithiated single wall carbon nanotubes

AUTHOR(S): Gabrisch, Heike; Yazami, Rachid; Fultz, Brent

CORPORATE SOURCE: Division of Engineering and Applied Science,
California Institute of Technology, Pasadena,
CA, 91125, USA

SOURCE: Proceedings - Electrochemical Society (
2003), 2001-21(Batteries and
Supercapacitors), 351-359
CODEN: PESODO; ISSN: 0161-6374

PUBLISHER: Electrochemical Society

DOCUMENT TYPE: Journal

LANGUAGE: English

AB Single-walled C nanotubes were reacted with molten Li at 220°
for 2 wk. X-ray and TEM studies indicate that a significant
fraction of the initial SWNTs transformed from cylindrical
C nanotubes to flat nanostrips having intercalated Li between them.
The Li atoms form a superlattice commensurate with that of
graphite-like nanostrips with $a\sqrt{7} + a\sqrt{3}$
in-plane distribution. This new structure corresponds to a LiC10
compn. A minor phase of LiC8 was also detected by TEM-diffraction.

IT 7439-93-2, Lithium, reactions

RL: RCT (Reactant); RACT (Reactant or reagent)

(LiC10 and LiC8 structures formed by chem. lithiation of

single-walled carbon nanotube anode
material for lithium batteries)

RN 7439-93-2 HCAPLUS
CN Lithium (7CI, 8CI, 9CI) (CA INDEX NAME)

Li

IT 7440-44-0, Carbon, uses
RL: RCT (Reactant); TEM (Technical or engineered material use); RACT
(Reactant or reagent); USES (Uses)
(nanotubes; LiC10 and LiC8 structures formed by chem.
lithiation of single-walled carbon nanotube
anode material for lithium batteries)
RN 7440-44-0 HCAPLUS
CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

CC 52-2 (Electrochemical, Radiational, and Thermal Energy
Technology)
Section cross-reference(s): 78
ST lithium carbide anode lithiation carbon
nanotube unzipping lithium battery
IT Battery anodes
(LiC10 and LiC8 structures formed by chem. lithiation of
single-walled carbon nanotube anode
material for lithium batteries)
IT Nanotubes
(carbon; LiC10 and LiC8 structures formed by chem.
lithiation of single-walled carbon nanotube
anode material for lithium batteries)
IT 84863-15-0 143436-38-8
RL: FMU (Formation, unclassified); PRP (Properties); FORM
(Formation, nonpreparative)
(LiC10 and LiC8 structures formed by chem. lithiation of
single-walled carbon nanotube anode
material for lithium batteries)
IT 7439-93-2, Lithium, reactions
RL: RCT (Reactant); RACT (Reactant or reagent)
(LiC10 and LiC8 structures formed by chem. lithiation of
single-walled carbon nanotube anode
material for lithium batteries)
IT 7440-44-0, Carbon, uses
RL: RCT (Reactant); TEM (Technical or engineered material use); RACT
(Reactant or reagent); USES (Uses)
(nanotubes; LiC10 and LiC8 structures formed by chem.
lithiation of single-walled carbon nanotube
anode material for lithium batteries)
REFERENCE COUNT: 11 THERE ARE 11 CITED REFERENCES AVAILABLE
FOR THIS RECORD. ALL CITATIONS AVAILABLE
IN THE RE FORMAT

L22 ANSWER 2 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2003:617876 HCAPLUS
DOCUMENT NUMBER: 139:352595
TITLE: Investigation of Lithium Storage in Bamboo-like
CNTs by HRTEM
AUTHOR(S): Wang, Qing; Li, Hong; Chen, Liquan; Huang,
Xuejie; Zhong, Dingyong; Wang, Enge
CORPORATE SOURCE: Laboratory for Solid State Ionics, Chinese
Academy of Sciences, Beijing, 100080, Peop. Rep.
China

SOURCE: Journal of the Electrochemical Society (**Aug 5, 2003**
2003), 150(9), A1281-A1286
CODEN: JESQAN; ISSN: 0013-4651
PUBLISHER: Electrochemical Society
DOCUMENT TYPE: Journal
LANGUAGE: English

AB **Multiwalled C nanotubes (CNTs)**
) with bamboo-like cavity structures (BCNTs) was studied by high
resoln. transmission electron microscope (HRTEM) as anode
materials for Li-ion batteries. It has a
reversible Li-storage capacity of 460 mA-h/g and a stable
cyclic capability. The HRTEM images of BCNTs at a Li
-inserted state as well as for a Li-extn. state were
obtained. An amorphous passivation film with a thickness of 5-7 nm
was obsd. on the outside of the BCNTs after discharge to 0 V. The
fringe spacings of the graphene wall expanded and the
graphite structure in some areas was partly damaged due to
the insertion of Li. Li nanocrystallites with
various lattice structures are presumably inside the tube. When the
samples were charged to 3.5 V, the stripes of Li
nanocrystallites disappeared and the graphene wall partly recovered
to the pristine state. This is the 1st direct observation of
Li storage within the cavities of C for a deep
Li-insertion state.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy
Technology)

Section cross-reference(s): 72

ST lithium storage bamboo carbon nanotube
anode battery

IT Battery anodes
(HRTEM of lithium storage in bamboo-like carbon
nanotubes)

REFERENCE COUNT: 34 THERE ARE 34 CITED REFERENCES AVAILABLE
FOR THIS RECORD. ALL CITATIONS AVAILABLE
IN THE RE FORMAT

L22 ANSWER 3 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2003:437381 HCAPLUS

DOCUMENT NUMBER: 139:263163

TITLE: Preparation and characterization of carbon
nanotubes for energy storage

AUTHOR(S): Wang, G. X.; Ahn, Jung-ho; Yao, Jane; Lindsay,
Matthew; Liu, H. K.; Dou, S. X.

CORPORATE SOURCE: Institute for Superconducting and Electronic
Materials, Battery Technology Research Program,
University of Wollongong, Wollongong, 2522,
Australia

SOURCE: Journal of Power Sources (2003),
119-121, 16-23

CODEN: JPSODZ; ISSN: 0378-7753

PUBLISHER: Elsevier Science B.V.

DOCUMENT TYPE: Journal

LANGUAGE: English

AB **Multiwall C nanotubes (MWNTs)** were
synthesized using CVD. The morphol. and microstructure of
MWNTs were obsd. via HRTEM. The multiwall C
nanotubes are entangled in bundles with a diam. of several
tens of nanometers. Electrochem. properties of MWNTs were
examd. via a variety of electrochem. tests. The MWNT
electrode demonstrated a reversible Li storage capacity of 340
mA-h/g with good cyclability at moderate c.d. The kinetic
properties of Li insertion in MWNTs electrodes were
characterized via a.c. impedance measurements. The Li diffusion
coeff. decreases with an increase in Li-ion concn. in the
MWNTs electrodes.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy

3/25/03

Technology)
Section cross-reference(s): 72
ST **multiwall carbon nanotube**
anode lithium ion battery
IT Nanotubes
(carbon; prepn. and characterization of **multiwall**
carbon nanotube electrodes for lithium-ion batteries)
IT Secondary batteries
(lithium; prepn. and characterization of **multiwall**
carbon nanotube electrodes for lithium-ion batteries)
IT **Battery anodes**
(prepn. and characterization of **multiwall**
carbon nanotube electrodes for lithium
-ion batteries)
IT 7439-93-2, Lithium, uses
RL: CPS (Chemical process); DEV (Device component use); PEP
(Physical, engineering or chemical process); PYP (Physical process);
PROC (Process); USES (Uses)
(prepn. and characterization of **multiwall carbon**
nanotube electrodes for lithium-ion batteries)
REFERENCE COUNT: 20 THERE ARE 20 CITED REFERENCES AVAILABLE
FOR THIS RECORD. ALL CITATIONS AVAILABLE
IN THE RE FORMAT

L22 ANSWER 4 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2002:501636 HCAPLUS

DOCUMENT NUMBER: 137:172340

TITLE: **Carbon nanotube**
anodes for lithium ion
batteries

AUTHOR(S): Raffaella, Ryne P.; Gennett, Thomas; Maranchi,
Jeff; Kumta, Prashant; Hepp, Aloysius F.; Heben,
Michael J.; Dillon, Anne C.; Jones, Kim C.

CORPORATE SOURCE: NanoPower Research Labs, Rochester Institute of
Technology, Rochester, NY, 14623, USA

SOURCE: Materials Research Society Symposium Proceedings
(2002), 706 (Making Functional
Materials with Nanotubes), 343-349
CODEN: MRSPDH; ISSN: 0272-9172

PUBLISHER: Materials Research Society

DOCUMENT TYPE: Journal

LANGUAGE: English

AB Highly purified single-wall **carbon nanotubes**
were investigated for use as an **anode** material for
thin-film **lithium-ion batteries**. The high
purity **nanotubes** were obtained by chem. refinement of soot
generated by pulsed laser ablation. The purity of the
nanotubes was detd. by thermogravimetric anal., SEM, and
transmission electron microscopy. The sp. surface area and
lithium capacity of the single-wall **carbon**
nanotubes was compared to that of other conventional
anode materials, i.e., **carbon black**,
graphite, and **multi-walled**
carbon nanotubes. The Brunauer-Emmett-Teller
technique based on nitrogen adsorption was used to measure the sp.
surface area of the various **anode** materials. The
single-wall **carbon nanotubes** exhibited a sp.
surface area on the order of 915 m²/g, much higher than the other
carbonaceous materials. Cyclic voltammetric behavior and the
lithium-ion capacity of the materials were measured using a
std. 3-electrode electrochem. cell. The cyclic voltammetry showed
evidence of staging that was similar to other carbonaceous
materials. The electrochem. discharge capacity of the purified
single-wall **carbon nanotubes** was in excess of
1300 mA-h/g after 30 charge/discharge cycles when tested using a
c.d. of 20 μ A/cm².

IT 7440-44-0, Carbon, uses
RL: CPS (Chemical process); DEV (Device component use); PEP
(Physical, engineering or chemical process); PROC (Process); USES
(Uses)
(nanotubes; investigation of carbon
nanotubes as anode for lithium-ion
batteries)
RN 7440-44-0 HCAPLUS
CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

CC 52-2 (Electrochemical, Radiational, and Thermal Energy
Technology)
ST carbon nanotube anode lithium
ion battery
IT Nanotubes
(carbon; investigation of carbon
nanotubes as anode for lithium-ion
batteries)
IT Battery anodes
(investigation of carbon nanotubes as
anode for lithium-ion batteries)
IT 7440-44-0, Carbon, uses
RL: CPS (Chemical process); DEV (Device component use); PEP
(Physical, engineering or chemical process); PROC (Process); USES
(Uses)
(nanotubes; investigation of carbon
nanotubes as anode for lithium-ion
batteries)

REFERENCE COUNT: 13 THERE ARE 13 CITED REFERENCES AVAILABLE
FOR THIS RECORD. ALL CITATIONS AVAILABLE
IN THE RE FORMAT

L22 ANSWER 5 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2002:288161 HCAPLUS

DOCUMENT NUMBER: 137:111601

TITLE: Nanotubes as anode material for lithium-ion
batteriesAUTHOR(S): Loutfy, Raouf O.; Hossain, S.; Moravsky, A.;
Saleh, M.

CORPORATE SOURCE: MER Corporation, Tucson, AZ, USA

SOURCE: Perspectives of Fullerene Nanotechnology (
2002), 341-355. Editor(s): Osawa, Eiji.
Kluwer Academic Publishers: Dordrecht, Neth.
CODEN: 69CLLN; ISBN: 0-7923-7174-7

DOCUMENT TYPE: Conference

LANGUAGE: English

AB Carbon nanotubes including arc multi-
walled nanotubes (arc-MWNT), arc- and
laser-produced single-walled nanotubes
(SWNT), and catalytically grown multi-
walled nanotubes (vapor grown, VG MWNT,
and chem. vapor deposited, CVD MWNT) were investigated as
anode materials for lithium ion intercalation and
de-intercalation. As-produced arc-MWNT deliver capacity
in the range of 190-210 mA-h/g and an irreversible capacity in the
range of 90-140 mA-h/g. The reversible capacity improved to 310-340
mA-h/g with purifn. and opening of the ends of the tubes.
SWNT delivered relatively high reversible capacity of >600
mA-h/g but they were assocd. with very high irreversible capacity
(.apprx.200%) that makes these materials impractical to use as an
anode material for lithium batteries.
Vapor-grown nanofibers exhibited poor reversible capacity and also

very high irreversible capacity. On the other hand, CVD MWNT delivered >400 mA-h/g reversible capacity with relatively low irreversible capacity (<25%).

IT 7440-44-0, Carbon, uses
 RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)
 (nanotubes; carbon nanotubes as anode material for lithium-ion batteries)
 RN 7440-44-0 HCAPLUS
 CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 ST carbon nanotube anode lithium ion battery
 IT Battery anodes
 (carbon nanotubes as anode material for lithium-ion batteries)
 IT Nanotubes
 (carbon; carbon nanotubes as anode material for lithium-ion batteries)
 IT 7440-44-0, Carbon, uses
 RL: DEV (Device component use); TEM (Technical or engineered material use); USES (Uses)
 (nanotubes; carbon nanotubes as anode material for lithium-ion batteries)

REFERENCE COUNT: 5 THERE ARE 5 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L22 ANSWER 6 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2002:86130 HCAPLUS

DOCUMENT NUMBER: 136:372163

TITLE: Electrochemical lithium insertion in template-synthesized highly-aligned multi-wall carbon nanotubes

AUTHOR(S): Mukhopadhyay, I.; Inahara, J.; Hoshino, N.; Okino, F.; Kawasaki, S.; Touhara, H.; Kyotani, T.; Tomita, A.

CORPORATE SOURCE: Department of Materials Chemistry, Faculty of Textile Science and Technology, Shinshu University, Ueda, 386-8567, Japan

SOURCE: Proceedings - Electrochemical Society (2001), 2001-11(Fullerenes--Volume 11: Fullerenes for the New Millennium), 15-18
 CODEN: PESODO; ISSN: 0161-6374

PUBLISHER: Electrochemical Society

DOCUMENT TYPE: Journal

LANGUAGE: English

AB Anode performance of template-synthesized multi-wall carbon nanotubes (MWNTs) in Li batteries was investigated. The pristine sample showed irreversible and reversible capacities of 1340 and 300 mAh/g in the initial cycle. Heat treatment at 1000° increased the BET surface area with an increase in the irreversible and reversible capacities. However, with an increase in the heat-treatment temp. to 3000°, the irreversible and reversible capacities decreased to 663 and 200 mAh/g but the coulomb

efficiency increased by 10% in the initial cycle. High temp. treatment at 3000° induced better crystallinity and good alignment of the graphene layers along the c-axis that increases the coulomb efficiency.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

Section cross-reference(s): 72

ST carbon nanotube lithium battery anode

IT Battery anodes Nanotubes

(electrochem. lithium insertion in template-synthesized multi-wall carbon nanotubes)

IT Secondary batteries

(lithium; electrochem. lithium insertion in template-synthesized multi-wall carbon nanotubes)

REFERENCE COUNT: 7 THERE ARE 7 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L22 ANSWER 7 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2002:52347 HCAPLUS

DOCUMENT NUMBER: 136:328038

TITLE: Electrochemical Li insertion in B-doped multiwall carbon nanotubes

AUTHOR(S): Mukhopadhyay, I.; Hoshino, N.; Kawasaki, S.; Okino, F.; Hsu, W. K.; Touhara, H.

CORPORATE SOURCE: Department of Materials Chemistry, Faculty of Textile Science and Technology, Shinshu University, Ueda, 386-8567, Japan

SOURCE: Journal of the Electrochemical Society (2002), 149(1), A39-A44
CODEN: JESQAN; ISSN: 0013-4651

PUBLISHER: Electrochemical Society

DOCUMENT TYPE: Journal

LANGUAGE: English

AB Electrochem. Li insertion into boron-doped multiwall carbon nanotubes (B-MWNTs) was investigated in a nonaq. medium. Transmission electron microscopy observations showed that the walls of the tubes consisted of highly aligned ca. 35-45 graphene layers with good 3D ordering feature. Raman studies revealed that boron doping in multiwall carbon nanotubes (MWNTs) destroyed the local hexagonal symmetry. X-ray photoelectron spectra of B-MWNTs further supported the results of Raman spectra and confirmed the presence of BC3 nanodomains. N2 adsorption measurements indicated that the Brunauer-Emmett-Teller (BET) surface areas of undoped and doped nanotubes were 10 and 12 cm²/g, resp., with almost similar mesopore vols. Galvanostatic discharge-charge measurements revealed that the reversible capacity was 156 mAh/g for undoped and 180 mAh/g for B-doped nanotubes in the first cycle with almost equal coulomb efficiencies of 55-58%. The coulomb efficiency increased to more than 90% after the second cycle. Cyclic voltammetry (CV) showed that highly reversible intercalation/deintercalation of Li occurred with some undesirable redn. processes in the initial discharge process. The cycle lives of both undoped and doped samples were quite satisfactory. Slow-scan CV confirmed that the intercalation of lithium in these nanotubes occurred through staging transition, usually obsd. in Li graphite intercalation compds.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST battery anode carbon nanotube lithium intercalation

IT Nanotubes

(carbon; electrochem. Li insertion in B-doped multiwall

carbon nanotubes)
IT Battery anodes
Intercalation
(electrochem. Li insertion in B-doped multiwall
carbon nanotubes)
IT 7439-93-2, Lithium, processes
RL: PEP (Physical, engineering or chemical process); PRP
(Properties); PROC (Process)
(electrochem. Li insertion in B-doped multiwall carbon
nanotubes)
REFERENCE COUNT: 22 THERE ARE 22 CITED REFERENCES AVAILABLE
FOR THIS RECORD. ALL CITATIONS AVAILABLE
IN THE RE FORMAT .

L22 ANSWER 8 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2001:697561 HCAPLUS
DOCUMENT NUMBER: 136:56311
TITLE: Fluorotubes as Cathodes in Lithium
Electrochemical Cells
AUTHOR(S): Peng, Haiqing; Gu, Zhenning; Yang, Jiping;
Zimmerman, J. L.; Willis, P. A.; Bronikowski, M.
J.; Smalley, R. E.; Hauge, R. H.; Margrave, J.
L.
CORPORATE SOURCE: Department of Chemistry and the Center for
Nanoscale Science and Technology, Rice
University, Houston, TX, 77005, USA
SOURCE: Nano Letters (2001), 1(11), 625-629
CODEN: NALEFD; ISSN: 1530-6984
PUBLISHER: American Chemical Society
DOCUMENT TYPE: Journal
LANGUAGE: English
AB Fluorotubes (C2F) were prepd. by fluorinating SWNTs
(single wall carbon nanotubes) with F2/HF at 250 °C for 12 h
and were consequently used as cathode material in a lithium
electrochem. cell. The Raman and FTIR spectra of the fluorotubes
were investigated before and after the cell was discharged. The
discharging performance of the fluorotube/lithium electrochem. cell
was studied and compared with that of a carbon monofluoride
(CFx)/lithium cell. Thermodyn. calcns. using the ΔH_f°
of fluorotubes and carbon monofluoride indicated that the potential
of a fluorotube/lithium electrochem. cell, where the fluorotubes
were made by the fluorination of armchair (10,10) SWNTs,
should be 0.4 V higher than that of a carbon monofluoride/lithium
cell. The exptl. results support the theor. calcns. The relation
between SWNT diam. and cell potential was also
investigated.
CC 52-2 (Electrochemical, Radiational, and Thermal Energy
Technology)
Section cross-reference(s): 57, 72
ST lithium battery cathode fluorinated
carbon nanotube
IT Nanotubes
RL: DEV (Device component use); USES (Uses)
(carbon, fluorinated; fluorotubes as cathodes
in lithium batteries)
REFERENCE COUNT: 13 THERE ARE 13 CITED REFERENCES AVAILABLE
FOR THIS RECORD. ALL CITATIONS AVAILABLE
IN THE RE FORMAT

L22 ANSWER 9 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2001:498220 HCAPLUS
DOCUMENT NUMBER: 135:291163
TITLE: Effects of synthesis condition of graphitic
carbon nanotube on anodic property of Li-ion
rechargeable battery
AUTHOR(S): Ishihara, T.; Kawahara, A.; Nishiguchi, H.;

CORPORATE SOURCE: Yoshio, M.; Takita, Y.
Faculty of Engineering, Department of Applied
Chemistry, Oita University, Oita, 870-1192,
Japan

SOURCE: Journal of Power Sources (2001),
97-98, 129-132
CODEN: JPSODZ; ISSN: 0378-7753

PUBLISHER: Elsevier Science S.A.

DOCUMENT TYPE: Journal

LANGUAGE: English

AB Effects prepn. condition of **multi-wall carbon nanotube** on Li intercalation were investigated in this study. Both Li intercalation and reversible capacities increased with increasing contact time of CH₄ on Ni catalyst when the **multi-wall carbon nanotube** was prepd. Raman spectroscopy suggested that the content of graphitic carbon tube increased with increasing the contact time of CH₄ upon synthesis. Therefore, in case of tubular carbon, graphitic carbon also exhibited a larger capacity for Li intercalation comparing with that of amorphous one. Intercalation and reversible capacity for Li insertion at first cycle were attained to a value of 430 and 320 mAh/g, resp., on the carbon nanotube obtained at the contact time higher than 100 g-cat h/mol.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST **lithium rechargeable battery anode carbon nanotube**

IT **Battery anodes**
Intercalation
Nanotubes
(effects of synthesis condition of graphitic **carbon nanotube** on anodic property of Li-ion rechargeable **battery**)

REFERENCE COUNT: 9 THERE ARE 9 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L22 ANSWER 10 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2001:57665 HCAPLUS

DOCUMENT NUMBER: 134:103217

TITLE: Electrochemical lithium intercalation into **multiwall carbon nanotubes**: a micro-Raman study

AUTHOR(S): Maurin, G.; Bousquet, Ch.; Henn, F.; Bernier, P.; Almairac, R.; Simon, B.

CORPORATE SOURCE: LPMC, UMR 5617 CNRS, CC 003., University of Montpellier II Sciences et Techniques du Languedoc, Montpellier, F-34095, Fr.

SOURCE: Solid State Ionics (2000), 136-137, 1295-1299
CODEN: SSIOD3; ISSN: 0167-2738

PUBLISHER: Elsevier Science B.V.

DOCUMENT TYPE: Journal

LANGUAGE: English

AB The electrochem. intercalation of lithium into carbon electrodes contg. **multiwall carbon nanotubes** produced by elec. arc technique was carried out in button cells in different electrolytes. An exfoliation of graphene layers was obsd. with the electrolyte LiPF₆ (1M) dissolved in ethylene carbonate (EC), propylene carbonate (PC) and di-Me carbonate (DMC) (1:1:3 by vol.). Raman spectra were recorded to elucidate the lithium intercalation mechanisms of **multiwall nanotubes**. The spectral changes of the Raman E_{2g} band showed that the lithium was intercalated between graphene layers of carbon nanotubes without the formation of n-staged phases with n higher than 2 in contrast to the intercalation into graphite which proceeds via the formation of

staged graphite intercalation compds.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 49

ST lithium electrochem intercalation **multiwalled carbon nanotube**

IT **Nanotubes**
RL: PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(carbon fibers, **multiwalled**; micro-Raman study of electrochem. lithium intercalation into **multiwall carbon nanotubes**)

IT **Nanotubes**
RL: PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(carbon, **multiwalled**; micro-Raman study of electrochem. lithium intercalation into **multiwall carbon nanotubes**)

IT Intercalation
(electrochem.; micro-Raman study of electrochem. lithium intercalation into **multiwall carbon nanotubes**)

IT Secondary batteries
(lithium; micro-Raman study of electrochem. lithium intercalation into **multiwall carbon nanotubes**)

IT **Battery anodes**
Exfoliation
(micro-Raman study of electrochem. lithium intercalation into **multiwall carbon nanotubes**)

IT Carbon fibers, uses
RL: PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(**nanotube, multiwalled**; micro-Raman study of electrochem. lithium intercalation into **multiwall carbon nanotubes**)

IT 96-49-1, Ethylene carbonate 108-32-7, Propylene carbonate 616-38-6, Dimethyl carbonate 21324-40-3, Lithium hexafluorophosphate
RL: NUU (Other use, unclassified); TEM (Technical or engineered material use); USES (Uses)
(micro-Raman study of electrochem. lithium intercalation into **multiwall carbon nanotubes**)

IT 7439-93-2, Lithium, processes
RL: PEP (Physical, engineering or chemical process); PROC (Process)
(micro-Raman study of electrochem. lithium intercalation into **multiwall carbon nanotubes**)

IT 7440-44-0, Carbon, uses 7782-42-5, Graphite, uses
RL: PEP (Physical, engineering or chemical process); TEM (Technical or engineered material use); PROC (Process); USES (Uses)
(micro-Raman study of electrochem. lithium intercalation into **multiwall carbon nanotubes**)

REFERENCE COUNT: 11 THERE ARE 11 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L22 ANSWER 11 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2000:575465 HCAPLUS
DOCUMENT NUMBER: 133:166157
TITLE: First-Principles Study of Li-Intercalated Carbon Nanotube Ropes
AUTHOR(S): Zhao, Jijun; Buldum, Alper; Han, Jie; Ping Lu, Jian
CORPORATE SOURCE: Department of Physics and Astronomy, University of North Carolina at Chapel Hill, Chapel Hill, NC, 27599, USA

SOURCE: Physical Review Letters (2000), 85(8),
1706-1709
CODEN: PRLTAO; ISSN: 0031-9007
PUBLISHER: American Physical Society
DOCUMENT TYPE: Journal
LANGUAGE: English
AB We studied Li-intercalated carbon
nanotube ropes by first-principles methods. Results show
charge transfer between Li and C and small
structural deformation due to intercalation. Both the interior of
the nanotube and the interstitial space are susceptible
for intercalation. The Li intercalation potential of a
single-walled nanotube rope is
comparable to that of graphite and almost independent of
the Li d. up to around LiC₂, as obsd. in recent expts.
This d. is significantly higher than that of Li
-intercalated graphite, making the nanorope a promising
candidate for the anode material in battery
applications.
CC 52-2 (Electrochemical, Radiational, and Thermal Energy
Technology)
ST battery anode lithium intercalated
carbon nanotube
IT Battery anodes
Electronic structure
(first-principles study of lithium-intercalated
carbon nanotube ropes)
REFERENCE COUNT: 24 THERE ARE 24 CITED REFERENCES AVAILABLE
FOR THIS RECORD. ALL CITATIONS AVAILABLE
IN THE RE FORMAT

L22 ANSWER 12 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2000:398814 HCAPLUS
DOCUMENT NUMBER: 133:46090
TITLE: Electrochemical performance of carbon nanotube
materials in lithium ion batteries
AUTHOR(S): Liu, Ping; Hornyak, G. Louis; Dillon, Anne C.;
Gennett, Thomas; Heben, Michael J.; Turner, John
A.
CORPORATE SOURCE: National Renewable Energy Laboratory, Golden,
CO, 80401, USA
SOURCE: Proceedings - Electrochemical Society (
2000), 99-25, 31-39
CODEN: PESODO; ISSN: 0161-6374
PUBLISHER: Electrochemical Society
DOCUMENT TYPE: Journal
LANGUAGE: English
AB Single-walled (SWNT), multi-walled (MWNT) and
template-synthesized (TSNT) carbon nanotube
materials have been tested as anodes in lithium
batteries. MWNTs, made by an arc-discharge
process, showed reversible capacity of 200 mAh/g and flat profiles
similar to those of graphitic carbons. SWNTs,
prepd. by a laser vaporization method, exhibited lithium
intercalation behavior that depended on the prepn. conditions. In
particular, a high degree of lithium ordering was obsd. in
SWNTs prepd. in hydrogen/argon mixts. TSNTs, formed by
chem. vapor deposition (CVD) of propylene gas at 800°
C within porous alumina templates membranes, consisted of
nanocryst. and disordered graphite. We found that
increasing the diam. of TSNTs from 30 to 90 nm and annealing at
1200.degree.C improved the lithium storage
capacity.
CC 52-2 (Electrochemical, Radiational, and Thermal Energy
Technology)
Section cross-reference(s): 49, 57, 72

ST lithium battery carbon
nanotube electrochem performance; battery
anode carbon nanotube electrochem
performance
IT Battery anodes
Electric discharge
Laser ablation
(electrochem. performance of carbon nanotubes
in lithium ion batteries)
REFERENCE COUNT: 7 THERE ARE 7 CITED REFERENCES AVAILABLE FOR
THIS RECORD. ALL CITATIONS AVAILABLE IN
THE RE FORMAT

L22 ANSWER 13 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN
ACCESSION NUMBER: 2000:36485 HCAPLUS
DOCUMENT NUMBER: 132:154259
TITLE: Potential use of carbon
nanotubes as anode materials
for lithium batteries
AUTHOR(S): Touhara, Hidekazu
CORPORATE SOURCE: Dep. Mater. Chem., Fac. Textile Sci. Technol.,
Shinshu Univ., 3-15-1 Tokida, Ueda, 386-8567,
Japan
SOURCE: Oyo Butsuri (2000), 69(1), 33-37
CODEN: OYBSA9; ISSN: 0369-8009
PUBLISHER: Oyo Butsuri Gakkai
DOCUMENT TYPE: Journal; General Review
LANGUAGE: Japanese
AB A review with 22 refs. Both single-wall and multiwall
carbon nanotubes are amphoteric, and form donor
and acceptor compds. The nanosize space and texture of
carbon nanotubes allow electrochem.
lithium insertion and extrn. in an aprotic medium. The chem.
and electrochem. of carbon nanotubes are still
in their infancy, however, their properties have been suggesting the
potential for use as high-capacity anode materials for
rechargeable lithium batteries.
IT 7440-44-0, Carbon, uses
RL: DEV (Device component use); USES (Uses)
(nanotubes; potential use of carbon
nanotubes as anode materials for
lithium batteries)
RN 7440-44-0 HCAPLUS
CN Carbon (7CI, 8CI, 9CI) (CA INDEX NAME)

C

CC 52-0 (Electrochemical, Radiational, and Thermal Energy
Technology)
ST review carbon nanotube anode
lithium battery
IT Nanotubes
RL: DEV (Device component use); USES (Uses)
(carbon; potential use of carbon
nanotubes as anode materials for
lithium batteries)
IT Battery anodes
(potential use of carbon nanotubes as
anode materials for lithium batteries
)
IT 7440-44-0, Carbon, uses
RL: DEV (Device component use); USES (Uses)
(nanotubes; potential use of carbon
nanotubes as anode materials for

lithium batteries)

L22 ANSWER 14 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 1999:813044 HCAPLUS

DOCUMENT NUMBER: 132:110479

TITLE: Determination of the chemical diffusion
coefficient of lithium in **multiwall**
carbon nanotubes

AUTHOR(S): Maurin, G.; Bousquet, Ch.; Henn, F.; Simon, B.

CORPORATE SOURCE: LPMC, UMR 5617 CNRS, CC 003, LPMC, UMR 5617
CNRS, CC 003, University of Montpellier II
Sciences et Techniques du Languedoc,
Montpellier, F-34095, Fr.SOURCE: Ionics (1999), 5(1 & 2), 156-160
CODEN: IONIFA; ISSN: 0947-7047

PUBLISHER: Institute for Ionics

DOCUMENT TYPE: Journal

LANGUAGE: English

AB Electrochem. interaction of lithium into **multiwall** carbon
nanotubes produced by the arc-elec. technique has been
carried out in button cells to est. the solid state diffusion
coeffs. of lithium. The results are interpreted providing that the
lithium species enter the nanotubes perpendicularly to their walls
and thus give rise to a necklace structure as obsd. by TEM.
Finally, the results are compared with the data obtained for
different kinds of carbon: carbon fiber, petroleum coke and
graphite.CC 52-2 (Electrochemical, Radiational, and Thermal Energy
Technology)

Section cross-reference(s): 65, 72

ST **carbon nanotube lithium diffusion****coeff; battery anode carbon****nanotube lithium diffusion coeff**

IT Nanotubes

RL: DEV (Device component use); PRP (Properties); USES (Uses)
(carbon; detn. of chem. diffusion coeff. of lithium in
multiwall carbon nanotubes)IT **Battery anodes**

Diffusion

(detn. of chem. diffusion coeff. of lithium in
multiwall carbon nanotubes)

IT 7440-44-0, Carbon, uses

RL: DEV (Device component use); PRP (Properties); USES (Uses)
(detn. of chem. diffusion coeff. of lithium in **multiwall**
carbon nanotubes)

IT 7439-93-2, Lithium, processes

RL: PEP (Physical, engineering or chemical process); PROC (Process)
(detn. of chem. diffusion coeff. of lithium in **multiwall**
carbon nanotubes)REFERENCE COUNT: 17 THERE ARE 17 CITED REFERENCES AVAILABLE
FOR THIS RECORD. ALL CITATIONS AVAILABLE
IN THE RE FORMAT

L22 ANSWER 15 OF 15 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 1999:465094 HCAPLUS

DOCUMENT NUMBER: 131:288742

TITLE: Electrochemical insertion of lithium in
catalytic **multi-walled**
carbon nanotubesAUTHOR(S): Leroux, F.; Metenier, K.; Gautier, S.;
Frackowiak, E.; Bonnamy, S.; Beguin, F.

CORPORATE SOURCE: CRMD, CNRS-Universite, Orleans, 45071, Fr.

SOURCE: Journal of Power Sources (1999),
81-82, 317-322

CODEN: JPSODZ; ISSN: 0378-7753

PUBLISHER: Elsevier Science S.A.

DOCUMENT TYPE: Journal
 LANGUAGE: English

AB Electrochem. lithium insertion was studied into purified and heat-treated catalytic multi-walled carbon nanotubes. It appears that the irreversible capacity for the MWNTs is relatively large, but decreasing with annealing temp. This clearly shows that the intrinsic entanglement and the microtexture of the nanotubes must be responsible for this drawback of any potential application as an anode. The crucial role of the charge cut-off on the 'traditional' intercalation was underlined and the reversible capacity was assigned to particular Li sites by high resolu. NMR spectroscopy.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
 Section cross-reference(s): 72

ST electrochem lithium insertion catalytic carbon nanotube; annealing multi walled carbon nanotube insertion; battery anode carbon nanotube lithium insertion

IT Nanotubes
 RL: DEV (Device component use); USES (Uses)
 (carbon; electrochem. insertion of lithium in catalytic multi-walled carbon nanotubes)

IT Annealing
 Battery anodes
 Oxidation
 (electrochem. insertion of lithium in catalytic multi-walled carbon nanotubes)

IT Intercalation
 (electrochem.; electrochem. insertion of lithium in catalytic multi-walled carbon nanotubes)

IT Secondary batteries
 (lithium; electrochem. insertion of lithium in catalytic multi-walled carbon nanotubes)

REFERENCE COUNT: 14 THERE ARE 14 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

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(FILE 'HOME' ENTERED AT 11:45:22 ON 23 OCT 2006)

FILE 'REGISTRY' ENTERED AT 11:52:21 ON 23 OCT 2006

L1 1 SEA ABB=ON PLU=ON CARBON/CN
 L2 1 SEA ABB=ON PLU=ON GRAPHITE/CN
 L3 1 SEA ABB=ON PLU=ON LITHIUM/CN

FILE 'HCAPLUS' ENTERED AT 11:53:19 ON 23 OCT 2006

L4 4455789 SEA ABB=ON PLU=ON L1 OR L2 OR CARBON OR GRAPHITE OR C
 L5 397713 SEA ABB=ON PLU=ON L3 OR LITHIUM OR LI
 L6 35853 SEA ABB=ON PLU=ON CNT OR CARBON NANOTUBE# OR NANOTUBE#
 L7 9345 SEA ABB=ON PLU=ON MWNT# OR SWNT# OR MULTI? WALL? (2A)
 NANOTUBE# OR MULTIWALL? (2A) NANOTUBE# OR SINGLE? (2A)
 WALL? NANOTUBE# OR SINGLEWALL? (2A) NANOTUBE#
 L8 486 SEA ABB=ON PLU=ON L4 (L) L6 (L) BATTER?
 L9 295 SEA ABB=ON PLU=ON L4 (L) L6 (L) BATTER? (L) L5
 L10 62 SEA ABB=ON PLU=ON L4 (L) L6 (L) BATTER? (L) L5 (L)
 CATHODE#
 L11 146 SEA ABB=ON PLU=ON L4 (L) L6 (L) BATTER? (L) L5 (L)
 ANODE#
 L12 27 SEA ABB=ON PLU=ON L10 AND L11
 L13 14 SEA ABB=ON PLU=ON L10 AND L7
 L14 37 SEA ABB=ON PLU=ON L11 AND L7
 L15 27 SEA ABB=ON PLU=ON L12 AND ELECTROCHEM?/SC,SX

L16 19 SEA ABB=ON PLU=ON L15 AND (1840-2003)/PRY,PY,AY
 L17 43 SEA ABB=ON PLU=ON L13 OR L14
 L18 41 SEA ABB=ON PLU=ON L17 AND ELECTROCHEM?/SC,SX
 L19 21 SEA ABB=ON PLU=ON L18 AND (1840-2003)/PRY,PY,AY
 L20 1 SEA ABB=ON PLU=ON 2004:1019587/AN
 L21 20 SEA ABB=ON PLU=ON L20 OR L16
 L22 15 SEA ABB=ON PLU=ON L19 NOT L21
 L23 582 SEA ABB=ON PLU=ON NANOTUBE# (2A) CATHODE#
 L24 180 SEA ABB=ON PLU=ON NANOTUBE# (2A) ANODE#
 L25 22 SEA ABB=ON PLU=ON L23 AND L24
 L26 6 SEA ABB=ON PLU=ON L25 AND ELECTROCHEM?/SC,SX
 L27 1 SEA ABB=ON PLU=ON L26 AND (1840-2003)/PRY,PY,AY
 L28 476 SEA ABB=ON PLU=ON NANOTUBE# (L) CATHODE# AND NANOTUBE#
 (L) ANODE#
 L29 37 SEA ABB=ON PLU=ON L28 AND (LI OR LITHIUM)
 L30 34 SEA ABB=ON PLU=ON L28 AND (LI OR LITHIUM) AND BATTER?
 L31 23 SEA ABB=ON PLU=ON L30 AND (1840-2003)/PRY,PY,AY
 L32 23 SEA ABB=ON PLU=ON L31 OR L27
 L33 4 SEA ABB=ON PLU=ON L32 NOT (L21 OR L22)

=> file reg

FILE 'REGISTRY' ENTERED AT 13:24:34 ON 23 OCT 2006

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PLEASE SEE "HELP USAGETERMS" FOR DETAILS.

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L1 1 SEA FILE=REGISTRY ABB=ON PLU=ON CARBON/CN
 L2 1 SEA FILE=REGISTRY ABB=ON PLU=ON GRAPHITE/CN
 L3 1 SEA FILE=REGISTRY ABB=ON PLU=ON LITHIUM/CN
 L4 4455789 SEA FILE=HCAPLUS ABB=ON PLU=ON L1 OR L2 OR CARBON OR
 GRAPHITE OR C
 L5 397713 SEA FILE=HCAPLUS ABB=ON PLU=ON L3 OR LITHIUM OR LI
 L6 35853 SEA FILE=HCAPLUS ABB=ON PLU=ON CNT OR CARBON NANOTUBE#
 OR NANOTUBE#
 L7 9345 SEA FILE=HCAPLUS ABB=ON PLU=ON MWNT# OR SWNT# OR
 MULTI? WALL? (2A) NANOTUBE# OR MULTIWALL? (2A) NANOTUBE#
 OR SINGLE? (2A) WALL? NANOTUBE# OR SINGLEWALL? (2A)
 NANOTUBE#
 L10 62 SEA FILE=HCAPLUS ABB=ON PLU=ON L4 (L) L6 (L) BATTER?
 (L) L5 (L) CATHODE#
 L11 146 SEA FILE=HCAPLUS ABB=ON PLU=ON L4 (L) L6 (L) BATTER?
 (L) L5 (L) ANODE#
 L12 27 SEA FILE=HCAPLUS ABB=ON PLU=ON L10 AND L11
 L13 14 SEA FILE=HCAPLUS ABB=ON PLU=ON L10 AND L7
 L14 37 SEA FILE=HCAPLUS ABB=ON PLU=ON L11 AND L7
 L15 27 SEA FILE=HCAPLUS ABB=ON PLU=ON L12 AND ELECTROCHEM?/SC,
 SX
 L16 19 SEA FILE=HCAPLUS ABB=ON PLU=ON L15 AND (1840-2003)/PRY,
 PY,AY
 L17 43 SEA FILE=HCAPLUS ABB=ON PLU=ON L13 OR L14
 L18 41 SEA FILE=HCAPLUS ABB=ON PLU=ON L17 AND ELECTROCHEM?/SC,
 SX
 L19 21 SEA FILE=HCAPLUS ABB=ON PLU=ON L18 AND (1840-2003)/PRY,
 PY,AY
 L20 1 SEA FILE=HCAPLUS ABB=ON PLU=ON 2004:1019587/AN
 L21 20 SEA FILE=HCAPLUS ABB=ON PLU=ON L20 OR L16
 L22 15 SEA FILE=HCAPLUS ABB=ON PLU=ON L19 NOT L21
 L23 582 SEA FILE=HCAPLUS ABB=ON PLU=ON NANOTUBE# (2A) CATHODE#
 L24 180 SEA FILE=HCAPLUS ABB=ON PLU=ON NANOTUBE# (2A) ANODE#
 L25 22 SEA FILE=HCAPLUS ABB=ON PLU=ON L23 AND L24
 L26 6 SEA FILE=HCAPLUS ABB=ON PLU=ON L25 AND ELECTROCHEM?/SC,

SX

L27 1 SEA FILE=HCAPLUS ABB=ON PLU=ON L26 AND (1840-2003)/PRY,
PY,AY

L28 476 SEA FILE=HCAPLUS ABB=ON PLU=ON NANOTUBE# (L) CATHODE#
AND NANOTUBE# (L) ANODE#

L30 34 SEA FILE=HCAPLUS ABB=ON PLU=ON L28 AND (LI OR LITHIUM)
AND BATTER?

L31 23 SEA FILE=HCAPLUS ABB=ON PLU=ON L30 AND (1840-2003)/PRY,
PY,AY

L32 23 SEA FILE=HCAPLUS ABB=ON PLU=ON L31 OR L27

L33 4 SEA FILE=HCAPLUS ABB=ON PLU=ON L32 NOT (L21 OR L22)

=> file hcaplus

FILE 'HCAPLUS' ENTERED AT 13:25:37 ON 23 OCT 2006

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=> d l33 1-4 ibib abs hitstr hitind

L33 ANSWER 1 OF 4 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2004:994553 HCAPLUS

DOCUMENT NUMBER: 142:201507

TITLE: Micro battery based on carbon
nanotubes

INVENTOR(S): Ahn, Gye Hyeok; Lee, Young Hee; Yoo, Jae Eun

PATENT ASSIGNEE(S): Iljin Nanotech Inc., S. Korea

SOURCE: Repub. Korean Kongkae Taeho Kongbo, No pp. given
CODEN: KRXXA7

DOCUMENT TYPE: Patent

LANGUAGE: Korean

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
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KR 2003043177	A	20030602	KR 2001-74217	200111 27

PRIORITY APPLN. INFO.:

KR 2001-74217

200111
27

AB This micro battery is used as a miniaturized power supply.
The thin-film cathode comprises C nanotubes,
there is an anode of a thin film opposite the
cathode. A solid electrolyte thin film is placed between
the anode and the cathode. The cathode
includes a material which is made of the solid electrolyte filled
between the C nanotubes. The solid electrolyte is
selected from Li3PO4, LiPO3, LiBO2, LiO2, B2O3, V2O5, P2O5 and SiO2.

IC ICM H01G009-04

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)

ST carbon nanotube cathode electrolyte micro
battery

IT Battery cathodes
(carbon nanotube cathode material for micro
batteries)

IT Nanotubes
(carbon; micro battery based on carbon nanotubes)

IT Primary batteries
Secondary batteries

(micro battery based on carbon nanotubes)
 IT 1303-86-2, Boron oxide (B2O3), uses 1314-56-3, Phosphorus oxide (P2O5), uses 1314-62-1, Vanadium oxide (V2O5), uses 7631-86-9, Silica, uses 10377-52-3, Lithium phosphate (Li3PO4) 12136-56-0, Lithium superoxide 13453-69-5, Lithium metaborate (LiBO2) 13762-75-9, Lithium phosphate (LiPO3)
 RL: DEV (Device component use); USES (Uses)
 (carbon nanotube cathode material for micro batteries with)
 IT 7440-44-0, Carbon, uses
 RL: DEV (Device component use); USES (Uses)
 (nanotubes; micro battery based on carbon nanotubes)

L33 ANSWER 2 OF 4 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2004:820315 HCAPLUS

DOCUMENT NUMBER: 141:341628

TITLE: Semiconductor devices provided with monolithic solid thin-film micro-sized secondary battery built on semiconductor substrate as active cathode materials

INVENTOR(S): Baba, Mamoru

PATENT ASSIGNEE(S): Japan Science and Technology Agency, Japan

SOURCE: Jpn. Kokai Tokkyo Koho, 12 pp.

CODEN: JKXXAF

DOCUMENT TYPE: Patent

LANGUAGE: Japanese

FAMILY ACC. NUM. COUNT: 1

PATENT INFORMATION:

PATENT NO.	KIND	DATE	APPLICATION NO.	DATE
JP 2004281593	A2	20041007	JP 2003-69100	20030314

PRIORITY APPLN. INFO.:

JP 2003-69100

20030314

AB The title semiconductor devices have a solid thin-film micro-sized secondary battery built in monolithic formation patterned by photolithog. on a porous cathode active material which is reformed from a portion of Si crystal semiconductor substrate or from a carbon nanotube film from a portion of SiC crystal semiconductor substrate.

IC ICM H01L021-822

ICS H01L021-3063; H01L027-04; H01M004-02; H01M004-38; H01M004-58; H01M010-40; C01B033-02

CC 76-3 (Electric Phenomena)

Section cross-reference(s): 52

ST carbon nanotube cathode silicon carbide reformation semiconductor substrate battery; silicon semiconductor device substrate monolith reformation porous cathode battery

IT Secondary batteries

(built in semiconductor device; semiconductor devices provided with monolithic solid thin-film micro-sized secondary battery built on semiconductor substrate as active anode materials)

IT Photolithography

(patterning of porous battery cathode from semiconductor substrate; semiconductor devices provided with monolithic solid thin-film micro-sized secondary battery built on semiconductor substrate as active anode materials)

- IT **Battery cathodes**
(porous semiconductor substrate; semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active anode materials)
- IT **Semiconductor devices**
(semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active anode materials)
- IT **Porous materials**
(silicon and silicon carbide; semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active anode materials)
- IT **Semiconductor materials**
(substrate, porous reformation for **battery** cathode; semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active anode materials)
- IT 12057-17-9, **Lithium** manganese oxide (LiMn_2O_4)
RL: PEP (Physical, engineering or chemical process); PRP (Properties); PYP (Physical process); PROC (Process)
(anode active materials; semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active anode materials)
- IT 11099-22-2
RL: DEV (Device component use); PRP (Properties); USES (Uses)
(contact interlayer; semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active anode materials)
- IT 7440-44-0P, Carbon, properties
RL: DEV (Device component use); PNU (Preparation, unclassified); PRP (Properties); PREP (Preparation); USES (Uses)
(**nanotubes**, semiconductor substrate reformed monolith porous **battery** cathode; semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active anode materials)
- IT 409-21-2, Silicon carbide, properties 7440-21-3, Silicon, properties
RL: DEV (Device component use); PEP (Physical, engineering or chemical process); PRP (Properties); PYP (Physical process); PROC (Process); USES (Uses)
(semiconductor substrate reformation for monolith porous **battery** cathode; semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active anode materials)
- IT 10377-52-3, **Lithium** phosphate (Li_3PO_4)
RL: DEV (Device component use); PRP (Properties); USES (Uses)
(solid electrolyte; semiconductor devices provided with monolithic solid thin-film micro-sized secondary **battery** built on semiconductor substrate as active anode materials)

L33 ANSWER 3 OF 4 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2004:230582 HCAPLUS

DOCUMENT NUMBER: 140:360197

TITLE: Reversible hydrogen and **lithium** storage of MoS_2 nanotubes

AUTHOR(S): Chen, J.; Li, S. L.; Tao, Z. L.; Zhang, L. Z.

CORPORATE SOURCE: Institute of New Energy Materials Chemistry, Nankai University, Tianjin, 300071, Peop. Rep. China

SOURCE: International Journal of Nanoscience (2002), 1(3 & 4), 295-302

CODEN: IJNNAJ; ISSN: 0219-581X

PUBLISHER: World Scientific Publishing Co. Pte. Ltd.

DOCUMENT TYPE: Journal

LANGUAGE: English

AB Inorg. fullerene-like MoS₂ nanotubes, synthesized by a gas-solid reaction, were used as electrode materials for H and Li storage in aq. and nonaq. electrolytes, resp. Results for reversible H redn./oxidn. and Li insertion were obtained.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 72

ST molybdenum sulfide nanotube anode
cathode hydrogen lithium storage battery

IT Battery anodes
Battery cathodes
Nanotubes
(reversible hydrogen and lithium storage in MoS₂ nanotubes for battery electrodes)

IT 1317-33-5, Molybdenum sulfide (MoS₂), uses
RL: DEV (Device component use); USES (Uses)
(nanotubes; reversible hydrogen and lithium storage in MoS₂ nanotubes for battery electrodes)

IT 1333-74-0, Hydrogen, processes 7439-93-2, Lithium, processes
RL: CPS (Chemical process); PEP (Physical, engineering or chemical process); PROC (Process).
(reversible hydrogen and lithium storage in MoS₂ nanotubes for battery electrodes)

REFERENCE COUNT: 23 THERE ARE 23 CITED REFERENCES AVAILABLE FOR THIS RECORD. ALL CITATIONS AVAILABLE IN THE RE FORMAT

L33 ANSWER 4 OF 4 HCAPLUS COPYRIGHT 2006 ACS on STN

ACCESSION NUMBER: 2001:3468 HCAPLUS

DOCUMENT NUMBER: 134:118312

TITLE: Template synthesis of nano-structured electrode materials and its electrochemical performance

AUTHOR(S): Zhao, Jian; Gao, Quan-yong; Yang, Yong; Lin, Zu-geng

CORPORATE SOURCE: State Key Lab for Phys. Chem. of Solid Surface and Dept. of Chem., Xiamen Univ., Xiamen, 361005, Peop. Rep. China

SOURCE: Dianhuaxue (2000), 6(4), 393-398

CODEN: DIANFX; ISSN: 1006-3471

PUBLISHER: Dianhuaxue Bianjibu

DOCUMENT TYPE: Journal

LANGUAGE: English

AB In this letter, various nano-structured materials such as spinel LiMn₂O₄ nanotubes/nanowires and carbon nanotubes have been prepd. by using porous alumina template. The prepd. template and materials have been characterized by AFM and TEM techniques. It is shown that size of the nanotubes can be conveniently controlled by using template method. Some preliminary results of cyclic voltammetry about nanostructured LiMn₂O₄ are also reported.

CC 52-2 (Electrochemical, Radiational, and Thermal Energy Technology)
Section cross-reference(s): 49

IT Battery anodes

Battery cathodes

Decomposition

Nanotubes

Sol-gel processing

(template synthesis of nanotube electrode material and its electrochem. performance)

IT 638-38-0, Manganese acetate 7790-69-4, Lithium nitrate
RL: NUU (Other use, unclassified); PEP (Physical, engineering or chemical process); PROC (Process); USES (Uses)

(template synthesis of nanotube electrode material and its electrochem. performance)

IT 7440-44-0P, Carbon, uses 12057-17-9P, Lithium manganese

oxide LiMn2O4

RL: SPN (Synthetic preparation); TEM (Technical or engineered material use); PREP (Preparation); USES (Uses)

(template synthesis of nanotube electrode material and its electrochem. performance)

REFERENCE COUNT: 11 THERE ARE 11 CITED REFERENCES AVAILABLE
FOR THIS RECORD. ALL CITATIONS AVAILABLE
IN THE RE FORMAT

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